

Report of Health Surveillance Activities

**Aerial Spraying for Asian
Gypsy Moth – May 2000
Seattle, WA**

July 2001



Environmental Health Programs

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Executive Summary

In May 2000, the biological insecticide Foray 48B was aerially applied three times in Seattle by the Washington State Department of Agriculture (WSDA) to prevent an infestation of Asian gypsy moth (AGM). The eradication effort targeted approximately one square mile of the Ballard and Magnolia areas. This is an urban area with an estimated 2,200 businesses and properties and an estimated residential population of 6,600.

The Department of Health (DOH) conducted health monitoring in order to identify serious reactions within the community and to document self-reported health symptoms among the residents. Community health concerns associated with the spray program were also noted.

DOH surveillance yielded reports of 59 persons in 50 households with at least one health symptom occurring after aerial spraying for Asian gypsy moth.

The most frequently reported symptoms were cough, headache, trouble breathing, sore throat, nasal congestion, and irritated eyes. Fourteen persons in eight families sought some type of health care for symptoms.

Community concerns centered around: whether aerial spraying was sufficiently justified; the desire for public disclosure of “inert” ingredients in the aerial spray; and questions about the safety of the spray for all individuals in the community.

Several large epidemiological studies have found no measurable increases in illness in communities where Foray 48B was applied by air. Still, many of the people reporting symptoms during the May 2000 AGM eradication project strongly believed that their symptoms were related to the spray. Data collected with a passive surveillance system will not be able to further resolve this apparent contradiction.

Health surveillance that controls for background rates of symptoms in the community would provide a better understanding of the relationship between symptoms reported and aerial spraying with Foray 48B. Surveillance would be especially useful if it were capable of detecting an increase in symptoms for which no health care was sought.

Community concerns could, in part, be addressed by: improving public participation in decision-making by the statewide gypsy moth program; greater public access to science-based health information; and expanding the independent review of undisclosed ingredients in Foray 48B.

Introduction

In May 2000, the biological insecticide Foray 48B was aerially applied three times in Seattle by the Washington State Department of Agriculture (WSDA) to prevent an infestation of Asian gypsy moth (AGM). The eradication effort targeted approximately one square mile of the Ballard and Magnolia areas. This is an urban area with an estimated 2,200 businesses and properties and an estimated residential population of 6,600. Sprayings were conducted on May 11th, 18th, and 25th and were carried out between 5:30 and 6:30 AM to minimize human exposure to spray droplets. The active ingredient in Foray 48B is *Bacillus thuringiensis kurstaki* (Btk), a natural agent of disease in caterpillars. Btk was selected for use because it is generally recognized as the safest insecticide currently available for gypsy moth control in urban areas.

There was a wide-scale effort to notify residents, businesses, and schools in the Ballard and Magnolia communities before each spraying. This effort included five direct mailings to each postal address in the targeted area, community meetings, and media coverage. In addition, individuals could request advance notice by phone one day before spraying. Washington State Department of Health (DOH) recommended that residents avoid direct exposure during spraying and remain inside for 30 minutes after the spraying to allow droplets to settle. These recommendations and the request to report health symptoms were included in the direct mailings and were discussed at community meetings.

DOH conducted health monitoring in order to identify serious reactions within the community and to document self-reported health symptoms among the residents. Community health concerns associated with the spray program were also noted.

Monitoring of health symptoms in the general public was done through passive surveillance with reports coming to DOH from a variety of sources. The majority of health complaints were referred to DOH by the toll-free AGM hotline. This telephone hotline was publicized in the news media and was listed in each of the five direct mailings sent to residents and businesses in the targeted area. It is a year-around hotline set up to provide information about the status of gypsy moth control activities statewide. For the six weeks during this project, the hotline was staffed by WSDA twelve hours/day with a message machine available after hours. Of the 2,179 total calls received by the hotline during the project, 42 were callers reporting a health complaint. These were forwarded to DOH for follow-up. Other symptom reports were received directly by the local health department (Public Health- Seattle and King County) and DOH. DOH identified additional individuals with health complaints during interviews with family members, friends, neighbors, and coworkers of ill persons. A standardized form was used to record symptoms, demographic information, self-assessment of severity of symptoms, and any health care obtained. A number of the individuals were contacted again by DOH after subsequent sprayings to track additional reactions.

Health care providers in King County, including the Washington Poison Center, were asked to report to DOH any cases of illness that might be related to the spraying. Public Health – Seattle & King County contacted health care providers using broadcast fax, e-mail lists of emergency department directors in King County, and the EpiLog communicable disease newsletter before and during the spray period. Outreach included information about the spraying, potential

adverse health effects, and the request to report possible illnesses. Information was also posted on the Public Health-Seattle King County website.

Public Health- Seattle King County requested all clinical microbiology laboratories in King County to forward to the DOH Public Health Laboratory all isolates of *Bacillus* species from wounds or normally sterile sites during and for 30 days after the spray period. DOH has the capacity to analyze an isolate of *Bacillus* and identify it as the strain of Btk (Btk HD-1) used in the Foray 48B spray. This surveillance was done in order to determine whether the strain used in Foray was responsible for any infections.

Results

DOH surveillance yielded reports of 59 persons in 50 households with at least one health symptom occurring after an aerial spraying for Asian gypsy moth. Most reports were referred from the toll-free AGM hotline. The sources of reports are listed in Table 1.

Table 1

Sources of symptom reports received by DOH

AGM telephone hotline	42
Direct to DOH	6
Family members	6
Public Health - Seattle and King Co.	5
Referrals from friends, coworkers, neighbors	4
Health care providers including the WA Poison Center	8
Email to WSDA	2

The total from this table (73) exceeds the actual number of cases reported (59 reports) because some cases were reported by more than one source. For example, all cases referred by health care providers and the Poison Center were also referred to DOH by another source.

DOH was able to follow up on 52 of the 59 reports received. For the remaining seven referrals, either no contact information was provided on the referral or the complainant failed to respond to DOH phone calls. Information from the initial referral on these seven reports is presented in the column “other reports” in the tables below.

Most reports were received by DOH within 36 hours of a spraying. Thirty reports were received after the first spraying, 22 after the second, and 7 cases after the third. The majority of callers resided within or near the spray boundaries; however, no calls were excluded from the analysis based on location of described exposure.

Table 2 lists self-reported demographic characteristics of the 59 cases. Reports primarily involved adults. Females reported symptoms more than males by a ratio of two-to-one. Only five persons reporting symptoms described feeling spray droplets on their skin. The remainder described normal daily activities such as walking their dogs in the neighborhood, walking to their car, and gardening, that may have resulted in exposure to surface or airborne spray residues. Exposure was not actually measured or confirmed in any case.

Table 2**Demographic characteristics of persons reporting symptoms**

	DOH contacted	other reports*	Total
Individuals reporting at least one symptom	52	7	59
Gender			
Male	16	3	19
Female	36	3	39
Unknown	0	1	1
Age			
Under 10	5	0	5
10-19	0	0	0
20-29	2	0	2
30-39	11	0	11
40-49	15	0	15
50-59	4	0	4
over 60	3	0	3
Adult of unspecified age	12	7	19

*Reports referred to DOH for which we were unable to collect follow-up information

Use of Health Care

Seven out of 59 individuals reported to DOH they had seen a health care provider for their symptoms. Three of the seven were willing to provide the name of their doctor and their case report was forwarded to a DOH medical epidemiologist for follow-up. One was diagnosed with bronchitis in the emergency room, another was assessed as having a mild form of reactive airways disease, and the third was diagnosed with worse than her normal allergy symptoms.

An additional seven cases, all from two families, were seen by a doctor after the DOH interview. These seven cases were reported to DOH by their doctor. They were diagnosed with "respiratory problems, mostly allergic bronchitis."

Symptoms Reported

The most frequently reported symptoms were cough, headache, trouble breathing, sore throat, nasal congestion, and irritated eyes. To summarize the nature and frequency of symptoms reported, cases were sorted into five descriptive categories: upper respiratory or nasal symptoms, temporary irritant symptoms, breathing difficulty, flu-like or viral symptoms, and skin rash. Eleven of the 59 reports met the criteria for two categories. The criteria for categorizing symptom reports are described below.

1. Upper respiratory and nasal symptoms. These were reports of primarily upper respiratory and nasal symptoms of variable duration. Included were allergy-type symptoms as well as reports consistent with sinus or respiratory infection. Reports were classified in this category if they

had one or more of the following: nasal congestion, sore or scratchy throat, productive and/or persistent cough, watery eyes, or headache.

2. Irritant symptoms These were reports of primarily irritant symptoms that were short-lived. Reports in this category had one or more of the following symptoms: burning or itchy eyes, burning in throat, nasal irritation, dry cough, itchy skin, or headache.
3. Airways involvement These were reports of possible bronchial or airways involvement that included one or more of the following symptoms: trouble breathing, chest tightness, or asthma reaction.
4. Flu-like or viral symptoms These were reports of flu-like or viral symptoms of variable duration that included at least two of the following: diarrhea, nausea, vomiting, fever, body aches, headache, or dizziness.
5. Skin rash Reports of any type of skin rash.

The nature and frequency of health effects reported by the community are summarized in Table 3 and discussed in detail below. The 11 cases that fell into two categories appear in the summary statistics for both categories.

Table 3

Nature and frequency of symptoms reported

Symptoms Reported	DOH contacted	other reports ¹	Total (%) ²
Upper respiratory and nasal symptoms	21	2	23 (39%)
Irritant symptoms	14	2	16 (27%)
Airways involvement	16	0	16 (27%)
Flu-like symptoms	7	0	7 (12%)
Skin rash	4	1	5 (8%)
Other	1	0	1
Unspecified or insufficient information to classify	0	2	2

¹reports referred to DOH for which we were unable to collect follow-up information

²percentage of the 59 reports that were classified in each category. The totals exceed the actual number of reports because 11 cases appear in two categories.

Upper Respiratory and Nasal Symptoms: Reports of primarily upper respiratory and nasal symptoms of variable duration were received from 23 people in 19 households. Allergy-type symptoms and reports consistent with sinus or respiratory infection were common among these 23 reports. Severity, as reflected by duration of symptoms and frequency of medical care, was highest in this category of reports. Nine persons (in five families) sought health care for symptoms. Diagnoses included bronchitis, allergic bronchitis, mild episode of reactive airways disease, and reaction consistent with patient history of chemical sensitivity.

Information on prior history of allergies, asthma, or other health conditions was collected for 17 of the 23 symptom reports. Eleven people reported pre-existing allergies, asthma, or other health conditions. Other health conditions reported were: recent pneumonia, unspecified bronchial condition, and multiple chemical sensitivities.

Irritant-type symptoms: Irritant symptoms that lasted less than 24 hours were reported by 16 persons. Included in this category were two reports of mild headache from individuals in the same family. Most cases in this category reported no other symptoms although three persons reported flu-like or mild viral symptoms in addition to the short-lived irritant symptoms. Seven of these reports came from persons with a known history of allergies. Individual histories of allergy ranged from simple hay fever to multiple sensitivities to foods, molds, dusts, animal dander, latex rubber, etc.

Symptoms involving airways: 16 persons reported at least one symptom that suggested involvement of airways. Five of the 16 people sought health care. Symptoms described by callers ranged from mild chest tightness lasting a few hours to episodes of wheezing lasting several days. Half of these cases also reported other symptoms such as allergy-type reactions (upper respiratory or nasal symptoms (five cases), flu-like symptoms (two cases), and blotchy skin (one case)). The remaining persons reported only airways symptoms: seven reported asthma reactions and one reported a feeling of tightness in her chest.

Seven persons reported worsening asthma or an asthma attack after at least one of the sprayings. All seven self-reported a history of asthma and allergies. In two instances, individuals were outdoors during the spraying and had direct skin contact with spray droplets. Both reported wheezing throughout the day despite use of inhalers. After subsequent sprayings both individuals stayed inside the recommended 30 minutes and had no further problems. Two other individuals had mild asthma in combination with viral or flu-like symptoms such as fever, diarrhea, nausea and headache. Two others reported prolonged asthma reactions lasting more than four days after a spray date. Both complained that their normal allergy medications did not seem to alleviate the symptoms. The seventh individual had advanced emphysema and asthma and his only exposure occurred while walking along the western boundary of the sprayed area on his way to work within an hour of spraying. He reported asthma reactions lasting one to two days after each of the first two spray dates despite the use of inhalers. He was notified in advance of the third application and, under physician advice, he began albuterol treatment two days prior to the third spraying and continued it for two days post application. He had no asthma reaction after the third spraying. While most persons with asthma reactions took medications to control wheezing and some sought medical advice over the phone, none reported visiting their health care provider for symptoms.

Viral and flu-like symptoms: Seven persons in six households reported viral or flu-like symptoms. Most of these cases also reported either irritant or airways symptoms. Only one person reported seeking medical care for symptoms.

Rashes: Only one of the five persons who reported feeling spray droplets on skin or clothing reported a skin rash. The one person who did develop a rash after direct exposure to her face reported that she washed her face immediately but that four hours later her face felt hot and was noticeably red with some puffiness around the eyes. She washed again and symptoms resolved without treatment by mid-afternoon the same day. Also reported were a flat splotchy rash on the face after riding a bus through the sprayed zone shortly after spraying; red raised bumps on neck, face, and ears after gardening 13 blocks east of the spray zone (3 days post-spraying); and itchy, red palms with no identified exposure except for walking dogs in the sprayed area. One person

reported that she called her doctor for advice. The other four rashes had resolved without medical treatment at the time of the DOH interview.

Children: DOH received reports of five children under the age of ten with at least one symptom. According to their parents, one child had a headache; one child with a history of asthma had wheezing and fever which may have been related to onset of a cold according to his mother; two children in the same family had coughing; and one child had initial irritant symptoms followed by two weeks of fever, nausea, sore throat, and persistent cough. The same health care provider saw the latter three children along with their sick parents. The provider described the symptoms of both families as being consistent with allergic bronchitis.

Surveillance for *Bacillus* isolates: The Public Health Laboratory received 13 isolates of *Bacillus* from various King County institutions during the surveillance period. Pulsed field gel electrophoresis was performed on the only Bt isolate received. It was confirmed to be *Bacillus thuringiensis israelensis*. No isolates of Btk were received.

Community Concerns

DOH received numerous calls from concerned citizens before and after the spray applications. Community concerns and questions included the following:

- Concern about the involuntary nature of the community wide exposure to the moth spray. Some residents chose to leave the area during spraying but a number were still concerned because there was no practical way to prevent spray residues from reaching their yard.
- Concern over other ingredients in the Foray 48B. Some ingredients in Foray 48B are protected by trade secret law and were not disclosed to the public. This prevented concerned citizens from conducting their own evaluation of the ingredients.
- Concerns about long-term health effects of community wide spraying.
- Concern with the inability of diagnostic testing to determine whether an individual's irritant, respiratory, or allergic symptoms were caused by Foray 48B.
- Concern about potential health impact to pets living in the sprayed area.
- Requests to consider newly published health research concerning Btk.
- Two requests for a reimbursement system for people seeking medical care or alternative accommodations.
- Concern over the potential for the moth spray to drift to other neighborhoods.
- Questions about the scientific necessity of gypsy moth eradication and requests that alternative control methods be tried before aerial spraying.
- A number of residents expressed confusion and frustration about the public's opportunity to offer meaningful input into the state plan to spray for AGM.
- Several people indicated that they would be more comfortable reporting health complaints directly to a health agency than to the Department of Agriculture's hotline.

Discussion

DOH received reports of symptoms in 59 persons in 50 households out of an estimated residential population of 6,600. Passive surveillance, like the system used by DOH to collect health complaints, relies on residents, physicians and laboratories to report symptoms and is likely to miss some of the disease events it was designed to capture. Health complaints will be missed if people are unaware of the request for reporting, are reluctant to report personal health information to a government agency, or feel that a symptom is too minor to report. While only a small percentage (less than 1%) of the total population in the sprayed area reported experiencing symptoms, it is not known how many people experienced symptoms but did not report them.

We gain some indication of the level of under-reporting during this spray project by comparing our results with a telephone survey of randomly selected residents conducted by the Department of Agriculture six months after the last spray application¹. Out of 339 residents of the Ballard/Magnolia sprayed area polled, 29 (9%) answered yes to the question “did you or anyone in your household notice health related effects that you attribute to the spraying?” Only three of 29 households recalled discussing symptoms with a health agency. Depending on the assumed size of the households surveyed, somewhere between 3-9% of the people represented by this survey believed they were affected in some manner by the spraying. There are several sources of possible bias in this survey, which limit conclusions from its results. Only 61% of households selected agreed to complete the survey. There is no information about the 39% who refused to answer some or all of the questions so we do not know whether they differed significantly from the people who completed the survey. For instance, people who recalled symptoms may be more likely to complete the survey. The survey was also sponsored by the Department of Agriculture, which had a poor relationship with many in the community who opposed the spraying. Finally, accuracy in remembering events diminishes with time; residents were asked to recall symptoms from six months ago.

The types of symptoms reported to DOH were primarily irritant and allergy-type symptoms involving the respiratory system. Reports of coughing, sore throat, sinus or nasal congestion, breathing problems, itchy or irritated eyes, and headache were the most frequent symptoms reported. A smaller number of people reported flu-like symptoms or skin rash. The nature of symptoms reported are consistent with symptoms reported to other passive surveillance efforts during gypsy moth control programs in Oregon, Washington and British Columbia^(2,4-6) and are consistent with what residents reported in the above WSDA survey.¹

DOH received seven reports of asthma during the spraying project. The reported episodes of wheezing generally occurred on the morning of a spraying with some persons noting that wheezing returned after subsequent sprayings. Three persons noted that wheezing persisted despite use of inhalers. Several people reported success in preventing further asthma reactions by staying inside the recommended 30 minutes or by adjusting their medication protocol under the guidance of their physician. Persons with asthma may be more sensitive to inhaled irritants and it is plausible that asthma could be triggered by an application of Foray 48B.

Some of the other symptoms reported are similar to symptoms linked to inhalation of Foray 48B among more highly exposed ground sprayers in British Columbia⁵. Health and exposure

monitoring of these individuals showed that ground sprayers were 2-3 times more likely to report dry skin, chapped lips, runny nose, nasal stuffiness, and itching redness or burning in eyes compared to a control group of unexposed horticultural workers. Flu-like illness and headache were not elevated in the ground sprayers relative to controls. Health effects reported were generally mild and transient in nature; there were no serious health complaints and no time lost due to illness reported. The results of this study do suggest that Foray 48B may act as an irritant when inhaled in large amounts. It is important to note that these workers were exposed to many times more Foray 48B than the general population during aerial spraying (some workers exposed to air concentrations more than 1000 times higher). However, the general population tends to contain more sensitive individuals than a healthy working population and it is possible that some sensitive individuals could experience irritant effects at a lesser exposure.

Although some of the symptoms reported to DOH are plausibly due to Foray 48B, it is virtually impossible to determine whether symptoms experienced by any specific individual were the result of exposure to the spray. First, exposure to Btk was not measured. Second, all symptoms reported can be caused by a number of different agents. Spraying for gypsy moth coincided with the normal increase in allergy symptoms during the spring and many symptoms were also consistent with infectious agents common at this time of year. Third, there are no diagnostic tests that can determine if these types of symptoms were caused by Btk or other agents in the spray.

The exception in diagnostic testing is a test that can determine whether Btk is the active bacteria in a bacterial infection. It is worth noting that several large surveillance efforts have looked for Btk infections following aerial spraying with Foray 48B but none have identified a problem to date^(2,5,6). DOH surveillance for cases of Btk infections after this project also detected no infections linked to the gypsy moth spray.

Although the cause of an individual's symptoms was not possible to determine, it is possible to measure community-wide health impacts from aerial spraying with epidemiological tools. These methods generally involve comparing the health status of residents in a sprayed area to residents in a similar but unsprayed area. Several epidemiological efforts have looked for changes in the health status of urban populations after aerial applications of Foray 48B. These studies have not detected negative impacts to health. These are briefly discussed below.

During use of Foray 48B in 1999 in British Columbia², a general population survey compared 522 participants within the sprayed area and 487 participants outside of the sprayed area. Participants were interviewed by phone before and within three days of spraying. They were asked general questions about their health and asked to list their specific symptoms. There were no differences between the two groups before or after the spraying. There was no measurable increase in symptoms following spraying reported by participants living in the sprayed area. Although people from within the targeted area reported symptoms to a hotline, which they believed were related to the spray, no increase in symptoms over background was apparent.

Because persons with asthma have been identified as potentially more sensitive to the spray, at least three studies have looked for an increase in medical visits for asthma in areas that have been sprayed with Foray 48B^(2,3,5). No increases were detected. One study included surveillance

for mild changes in childhood asthma for which no health care was sought. Twenty-nine children with prior history of moderate to severe asthma were matched by gender and age with the same number of asthmatic children outside the spray zone². Respiratory health of the children was assessed by peak expiratory flow measurement twice a day and by daily recording of symptoms. Nasal swabs collected the evening before each spray and two hours after the spray were assessed for presence of the Btk strain used in Foray 48B. Although nasal swabs were positive for Btk in a number of children in the sprayed area, there was no evidence that the spray affected their asthma.

Two epidemiological studies have assessed health effects for which people sought health care following aerial spraying of Foray 48B. In 1996, New Zealand evaluated visits to a medical center in a repeatedly sprayed region of Auckland (80,000 people in 30,000 households)³. The study reviewed 5,506 patient records for five medical conditions: acute asthma, dermatitis, conjunctivitis, rhinitis, and motor vehicle injuries. There were no increased visits for the five conditions during the first month of spraying when compared to either the month prior to spraying or the same month the year before when no spraying had occurred. This study also examined hospital discharges from the sprayed region during the entire eight month spray period and compared it to unsprayed areas of Auckland and to prior years when no spraying occurred. No increases in admissions for corneal ulcer, acute respiratory infection, gastro-intestinal infections, or infectious and parasitic diseases were observed that were unique to the sprayed area. The study also checked hospital discharge data for incidence of miscarriage and prematurity. Admissions for both conditions declined during the spray year.

A similar monitoring effort in British Columbia in 1999 evaluated patient admission data for emergency rooms serving a sprayed area⁴. There was no increase in the number of visits for five specific conditions: respiratory illness, chronic obstructive pulmonary disease, asthma, dermatitis, and gastrointestinal illness.

While epidemiological evidence has not found measurable increases in illness in communities where Foray 48B was applied by air, many of the people reporting symptoms during this year's AGM eradication project strongly believed that their symptoms were related to the spray. A number of the reports received by DOH appeared to be temporally linked to the spraying. These included a skin rash that appeared within four hours of direct exposure to spray droplets and cases of adult asthma that worsened after each application. A number of persons who reported irritant effects such as burning eyes and nose noted that their symptoms followed each application. There appears to be a gap between what people living in sprayed communities report and what epidemiological tools have been able to detect. Data collected with a passive surveillance system will not be able to further resolve this apparent inconsistency.

DOH tracked use of health care in part to help design future surveillance. The majority of persons reporting symptoms did not seek health care for their symptoms. Seven persons sought health care from a naturopathic doctor. Only one sought medical care at an emergency room. No one was hospitalized. Health surveillance, which collects only data from hospital admissions or medical office visits, would miss most of the symptoms reported by individuals in the Ballard and Magnolia communities. The importance of including visits to practitioners of alternative medicine in medical visit surveillance is also underscored by the Ballard and Magnolia

experience. Further resolution of the extent of health impact will require monitoring of symptoms for which health care is not sought and would need to control for background rates of symptoms in the community.

Community concerns were reviewed with the Department of Agriculture after the spray project. Discussion included: methods for involving the community earlier in the decision-making process; improvements in public education about the opportunities for public comment; the importance of presenting a detailed scientific justification for any spraying; the value of using the Internet to field community questions and to disseminate public information; and options for expanding the review of pesticide inert ingredients to increase public confidence in the assessment.

Recommendations

- If aerial spraying for gypsy moth is deemed necessary in the future, current practice of providing wide notification of the project and the specific spray dates should continue. Dissemination of information to the public during the entire cycle of the project (i.e., pheromone trapping, ship inspections, moth suppression efforts in the Russian Far East, and other monitoring activities) may help to engage the public earlier in the process.
- Easier access to public documents would clarify the scientific basis for the decision to spray and would facilitate review and comment by the public and independent scientists. Especially beneficial would be improved access to the 1995 Environmental Impact Statement (EIS) for Gypsy Moth Management in the United States, which includes detailed ecological and human health risk assessments, the State Environmental Policy Act (SEPA) documents, and the site-specific Environmental Assessment, completed by WSDA's gypsy moth management program.
- Health agencies should consider an expanded effort to make science-based health information readily available via the Internet and through other known community information resources.
- Health surveillance that controls for background rates of symptoms would aid in understanding the relationship between symptoms reported and aerial spraying with Foray 48B. Surveillance would be especially useful if it were capable of detecting an increase in symptoms for which no health care was sought. Health surveillance should be designed well in advance of spraying and should reflect input from the community, independent scientists, and medical professionals. This type of health surveillance is resource intensive and could not be carried out within the current budgets of local or state health agencies. Additional funding sources would need to be identified.
- Health agencies conducting surveillance should consider soliciting health reports through a dedicated toll-free number. The number could be widely disseminated and would be a focus for health information, health concerns and symptoms reports.
- With additional resources, monitoring for air concentrations of Btk during and following spraying would better characterize community exposure and could provide a scientific

basis for health recommendations intended to help minimize exposure. Monitoring for spray drift in adjacent communities would also characterize wider community exposure and aid in advising adjacent communities in the future.

- Public health agencies should continue to encourage federal and state efforts to improve public disclosure of pesticide inert ingredients.

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